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ASTRONOMY

Eye May See Large Part of Whole Universe

By James Stokley

Eight hundred and forty million million million miles—that is the inconceivably vast distance that the sensitive eye of the most powerful telescope—the great hundred-inch reflector of the Mt. Wilson Observatory—can see. And when a telescope 300 inches in diameter, already planned, is completed, it will be possible to see as far as six thousand million million million miles, and to see these vastly distant objects with light that left them a thousand million years ago, when the earth itself was still young, and nearly a thousand million years before the first form of man appeared on the planet.

But not only would such a giant telescope reveal these inconceivably remote objects. It would actually reveal a considerable portion of the whole universe, if modern ideas are correct. It used to be thought that the universe was infinite—that if one could keep on travelling forever, he would never reach any boundary. But the idea of an infinite universe has several objections. For instance, it has been said that if this were the case, no matter which direction one travelled, he would eventually run into a star, and if stars were in all directions, the night sky would be bright.

However, Einstein, with his theory of relativity, offered a solution of the problem with his idea of an infinite, yet boundless, universe. Though this may seem a contradiction in terms, it has been compared to a sphere, on the surface of which some small animal, such as an ant, might travel forever, and never come to any end of the surface. The universe, say the supporters of Einstein, is similarly curved, not as a sphere, but in some fourth dimension of which our limited human faculties are unable to make us aware. But there are means for guessing the size of this super-spherical universe,

GREAT SPIRAL NEBULA IN ANDROMEDA, one of the stellar systems or galaxies like the one of which the sun and Milky Way are part, but outside its limits. This was one of the first of the distant objects studied by Dr. Hubble.

and it is supposed to be about a million million million million miles in diameter. If one could travel away from the earth, in what we call a straight line, but which is really curved on the surface of this sperical universe, for something like 3,141,-600,000,000,000,000,000 miles, he would then be right back where he started. Or, if he had a telescope that could see this far, he would be able to see the back of his head, or rather his remote ancestors could see it, for the light reflected from his head would travel 520,000,000,000 years before it came back to its starting point!

Such ideas as these represent a far cry from the ancient days when the earth was considered to be at the exact center of everything, and the other day in Washington, Dr. Edwin Hubble, of the Mt. Wilson Observatory, an eminent astronomer who has himself helped in a large measure to push back the boundary of observation, told of some of these advances.

"The history of astronomy is a history of receding horizons," he said. "Early investigations were concerned almost entirely with the system of the planets. Beyond was the visible boundary of the universe—a spherical shell studded with the fixed stars, at a distance of 80,000,000 miles from the earth. This barrier fell before the assaults of modern science. The stars came to be accepted as far away suns, scattered through the depths of space according to their faintness. Horizons receded as telescopes grew until finally evidence of another boundary began to appear. Dimly seen at first, they accumulated and grew legible until now it is realized that the stars themselves form a definite system, at least 100,000 light years in diameter, but quite isolated in space.

"The study of this, the galactic system, and its constituent stars, has developed with accelerated pace until within the last 30 years it has become the commanding feature of astronomical research. The study of the planetary system, although still fruitful and fascinating, has lost its unrivalled position in the new perspective.

"The methods fiirst used for investigating the galactic system were those developed in the study of the planetary system. The astronomy of position, however, has outlived much of its first urgent necessity and has been largely replaced by the new and more powerful methods of astrophysics. These were calibrated by the older methods, but once established, they have pushed out into regions far beyond the reach of the micrometer.

"These points have their analogies in the latest phase of astronomy. For history is repeating itself. Once the limited nature of the galactic system

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CLASS STUDY HELPS

Articles on following pages will be found especially useful in science class work:

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was realized, the question immediately arose as to space beyond the Milky Way. Speculation flourished. Assuming the uniformity of nature, men supposed that, scattered through space, there must be numberless other systems of the same order as our own. Unresolved nebulae were seized upon as visible evidence; the grand vague theory of island universes was launched upon its career. Controversies naturally arose, but the arguments on both sides were largely speculative. The observational data, scanty and indecisive at best, were interpreted to suit the occasion.

"Meanwhile the empirical study of nebulae progressed. The galactic star clusters, all resolved by the larger telescopes, were weeded out, and around them grew up a separate department of research. Among the unresolved objects, the diffuse nebulae and the planetaries were recognized as constituent members of the galactic system—clouds of dust and gas mingled with the stars. The controversy simmered down to the question of the spirals and other small symmetrical bodies which inhabit the regions of high galactic latitudes. Were these nebulae galactic or extra-galactic?"

Dr. Hubble himself has supplied the answer to this problem, for his photographs made with the great Mt. Wilson reflecting telescope, have at least revealed that these spiral nebulae actually are systems of stars like our own galaxy, but outside its boundaries. For the first time, these photographs revealed some of the actual stars of which they consist—not all the stars in them, it is true, for only the largest and brightest, the giants, as astronomers call them, will make their presence known. But they were stars just the same as those of the galaxy, their images on the plates were just as sharp and small, their colors showed

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News-Letter Features

Born over four years ago of the demand and interest of those individuals who had caught a glimpse of *Science Service's* news reports to newspapers, the SCIENCE NEWS-LETTER has since proved interesting to laymen, scientists, students, teachers and children.

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BIOLOGY

Basic Life Stuff Described

Protoplasm, the stuff that makes things alive, was described by Dr. Robert Chambers, professor of microscopic anatomy at Cornell Medical School, in a lecture at the Manhattan Trade School, Rapid advances are being made in our understanding of the chemical and physical foundations of life, the speaker said, and every day the secrets that lie in the living cell are more intimately penetrated.

Protoplasm, as Dr. Chambers described it, shows itself under the microscope to be a clear, colorless material, sometimes viscidly fluid like the white of a raw egg, sometimes firm and jelly-like. But whatever its state, it always shows three properties so long as it is not dead: it grows, it moves, it can "feel"—that is, it can respond to stimuli. Nothing that is not alive can do any of these three things.

Although protoplasm is necessarily present wherever life is present, it is divided into such tiny masses, each within a cell wall, that it cannot be collected into large quantities for ordinary chemical analysis without killing it, when it would, of course, no longer be protoplasm at all. It is therefore necessary to carry on all researches on it by means of powerful compound microscopes. Because of this limitation on research into the properties of living matter, scientists could learn nothing at all about it until the microscope was invented, and that occurred only as recently as the seventeenth century. It has, therefore, come to pass that gross physiology, which deals with the activities of the body in general and can be studied with the naked eye, aided by ordinary chemical and physical apparatus, got a much earlier start than microscopic physiology, which pries into the secrets of the tiny particles of protoplasm themselves. This situation, however, is rapidly being changed, for the science of microscopic physiology, especially during the last half of the nineteenth century and the first quarter of the twentieth which has just ended, has been making great strides to overtake its older companion.

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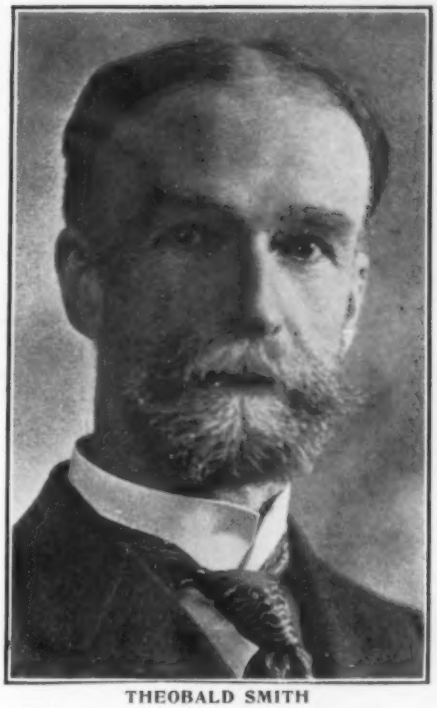
Women of the Iroquois tribe held office as chiefs.

The shipworm uses the edge of its shell as a boring tool.

Electric motors in the United States do as much work in a day as 170,000,000 men.

BACTERIOLOGY



THEOBALD SMITH

Pioneer Disease Detective

Of the discoverer of the cause of Texas tick fever, Paul de Kruif says: "He was first, and remains the captain of American microbe hunters. * * * He showed men an entirely new and fantastic way a disease may be carried —by an insect. Wipe out that insect, dip all of your cattle in fields where there are no ticks, and Texas fever will disappear from the earth. Today whole states are dipping their cattle and today Texas fever which once threatened the great myriads of American cattle is no longer a matter of concern."

Dr. Smith has likewise to his credit the discovery of the cause of bovine tuberculosis, and was the first to distinguish the bacillus from that causing the disease in human beings.

Born in Albany, N. Y., in 1859, he received his bachelor's degree a Cornell University and did his medical work at Albany Medical College. In 1884 he came to the U. S. Bureau of Animal Industry, then in a stage of its development that can best be described as embryonic. In spite of meager facilities it was during this period that he cleared up the mystery of tick fever. In 1895 he became director of the pathological laboratory of the Massachusetts State Board of Health and served at the same time as professor of comparative pathology on the faculty of Harvard University. Since 1915 he has been head of the department of animal pathology at the Rockefeller Institute for Medical Research at Princeton, N. J.

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ZOOLOGY

Mouse Plague Abating

Half a million dollars will probably be the loss to farmers from the severe plague of mice in Kern County, California, which now shows signs of abating. The U. S. Department of Agriculture joined farmers and state workers in conducting a poison campaign. Strychnin poison, laid about the edges of the great alfalfa-planted area where the mice are feasting, is killing them off by millions. At the end of a month the plague should be over, according to Vernon Bailey of the U. S. Biological Survey, and the farmers of Kern county will be able to start their spring planting with a clean slate—after paying the big board bill that the mice ran up during the plague.

Field mice present a real agricultural problem. Their appetite is for things important to man such as grass, grain, bark of trees, and even root crops and vegetables. They are almost incessant feeders and, moreover, are prolific and rapid breeders. The total increase from a pair of field mice, if all lived and bred, would be over 1,000,000 individuals at the end of a year. Thirty-eight states in this country are "mouse states" in which precautions should be taken to prevent such plagues as the one now raging in California. The only states in which mouse plagues may not arise are the states bordering on the Gulf of Mexico, and Tennessee, Kentucky, Arkansas and Oklahoma. As few as ten field mice to the acre on the 65,000,000 acres of hay raised in mouse states would cause a yearly money loss of some $30,000,000 in hay alone. During a mouse plague when the mice are present in much larger numbers the loss is immense.

To minimize the chances of such plagues, Mr. Bailey recommends that the farmers clean up the fields, meadows, borders, roadsides and ditch banks to give the herons, hawks, owls, gulls and other birds of prey a chance to see and catch the mice and thus preserve the necessary degree of control.

The situation in parts of France is so serious that the Pasteur Institute has been experimenting with a disease which kills off the mice in three days. Grain is soaked in a solution containing the bacilli which cause the disease. The mice eat the grain and develop a mortal distemper which they rapidly transfer to each other.

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The Aztecs took steam baths.

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the same range, some varied in light, while some novae, or "new stars" were found. "On the whole," said Dr. Hubble, "there is not the slightest reason to suppose them different from galactic stars.

"The importance of this conclusion lay in the fact that it permitted the application of the powerful methods of stellar research perfected in the study of the galactic system itself. Stars are familiar objects and may safely be assumed to exhibit the same general characteristics wherever they are found. This assumption, moreover, is supported by the consistency of an ever increasing mass of observational data and is of an entirely different nature from that involved in a mere speculation."

But such methods as these do not reach the limit. By studying the stars in the nebulae, astronomers can reach out as far as five million light years—or about thirty million million million miles. Light travels at a speed of about 186,000 miles in a second, and the distance that it will go in a year, about six million million miles, is a light year, one of the astronomer's units of measurement.

"For the further exploration of space," Dr. Hubble continued, "it has been necessary to develop new methods, applicable to nebulae in general. The extra-galactic nebulae form a homogenous group in which numbers increase rapidly with diminishing apparent size and brightness. Four are visible to the naked eye; 41 are found on the Harvard sky maps; 300,000 are estimated to be within the limits of a photograph with an hour's exposure through a 60-inch reflecting telescope. The progression indicates a wide range in distance or in absolute dimensions and it is necessary to disentangle these factors before venturing further on the study of cosmography. The objects are so varied and so numerous that statistical methods are required in order to make certain that the conclusions will be based upon normal nebulae and not upon exceptional cases. The first step, therefore, has been the investigation of a list of several hundred nebulae which is complete for the brighter objects and thoroughly representative for the fainter, down to a definite limiting luminosity. The investigations were necessarily restricted to data which could be derived from simple photographs—the forms of the images, the angular diameters and the apparent brightness. These were sufficient to establish surprisingly simple and general relations, which could be calibrated with the absolute data known for our nearer neighbors.

DR. EDWIN HUBBLE, astronomer of the Mt. Wilson Observatory whose observations of spiral nebulae have revealed stellar systems by light that left them 140 million years ago.

"In observing the most distant nebulae, we are witnessing scenes and events which actually happened in past ages. Recent history is on its way travelling with the speed of light but only a daring prophet would expect man to be still on earth to receive it. In a very real sense, then, extra-galactic nebulae can be classified in a geological time-scale. The nearest of them all, the Magellanic Clouds, are photographed in the light that left them more than 100,000 years ago. We see them as they actually were, say in the third interglacial epoch. No other nebulae can be referred to the Pleistocene period in the earth's history. The conspicuous spirals belong to the Pliocene period and stars can probably be detected as far back as the Miocene. Nebulae of the twelfth magnitude are perhaps Oligocene objects and those at the limit of the counts, representing an hour's exposure on fast plates with the 60-inch reflector at Mt. Wilson, are Cretaceous.

"Unless the density law breaks suddenly just at the limit of the 60-inch reflector, the 100-inch should reveal most of the two million or so nebulae which are within 140 million light years of our system.

"A sphere of this radius represents the observable region of space. In time, it goes back to the Carboniferous. Exceptionally bright objects could be detected at still greater distances, but normal nebulae must await faster plates and larger telescopes. Within this sphere the average distance between nebulae is of the order of 1,800,000 light years, although in the clusters it may be a tenth and less of this amount. The mean density of space is of the order of one nebulae in 3,700,000 million million cubic light years.

"Beyond the observable regions of space are the legitimate realms of speculation. The principle of the uniformity of nature appears to operate as far as telescopes can reach. The great discontinuity is at the borders of our own stellar system. Once that is bridged, no other is encountered within range of existing instruments. The ultimate barriers therefore are of a mechanical nature and it will be possible to push them back to several times their present distances. Meanwhile we can rely on the principle of uniformity and suppose that beyond the barriers, for a while at least, space is much the same as within the known region. This, however, cannot continue indefinitely. In the absence of internebular absorption, a uniform distribution of equally luminous nebulae would eventually produce a luminous background to the sky. No such phenomenon is observed. Moreover, it is well known that Newton's law of gravity cannot be reconciled with an infinite universe unless the latter is constructed in a very special manner.

"The general theory of relativity, however, avoids both of these difficulties by postulating a universe which is finite, although boundless.

"The total apparent luminosity of this universe of nebulae, as seen from the earth, would be somewhat less than that of the stars in the galactic system. Hence, the difficulty of a luminous background is avoided.

"The range of the 100-inch reflector for normal nebulae is about one twelve-hundredth of the diameter, hence even now we are observing an appreciable fraction of the Einstein universe. With larger telescopes and faster plates, such as are believed to be thoroughly practical, exceptionally bright nebulae might be detected at distances of the order of a twentieth of the diameter—might be photographed with light which started on its journey a thousand million years ago when the earth itself was young.

"But 'such speculations concern things beyond the horizon. A veil of obscurity divides them from the realm of the known and while vague shadows are sometimes glimpsed, it is

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difficult to tell from which side of the veil they are cast. These dim shapes will always hover along the last horizon, stirring the imagination, beckoning the searchers to new and far adventure. None who follow the call may win to the ultimate goal, but slowly through the ages, their reports are accumulating. And slowly there is emerging a definite conception of the nearer regions of the universe in which we live and think and dream."

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Concrete is now sprayed on building surfaces.

An omelet from an ostrich egg will feed eight persons.

Sacred bulls in Egypt were mummified and buried with great ceremonies after death.

In Roman days, the crater of Vesuvius was a favored hiding place for escaped slaves and brigands.

More than 1,000,000 ounces of silver are recovered from waste film and photographic solutions in a year.

Hawaiian soil is entirely volcanic lava.

The bald eagle is not bald, but has a white head.

A discovery of iron ore in the Italian Alps has been reported.

Germany is trying iron carbonyl as an anti-knock compound for gasoline.

Builders say that 63 per cent of the cost of a house is spent in putting the parts together.

"Bootleg" seeds of an inferior grade, mislabeled, have been causing trouble to farmers of some states.

More than 25,000 children in Georgia have been immunized against diphtheria in the past two months.

An Arizona canyon where Indians once held their ceremonies is to be made into a stadium seating 25,000 people.

Descendants from one pair of meadow mice, if all lived and bred, would number over a million mice at the end of a year.

Study Why Flyers Fly

Doctors and psychologists of the U. S. Air Service are trying to discover what it is that makes fliers fly.

"Everyone that wants to fly can't learn," says Major Francis H. Poole, chief of the School of Aviation Medicine now located at Brooks Field, San Antonio, Texas. "Many a man apparently physically and mentally fit and ambitious to become an aviator can never safely leave the ground. Inherent flying ability is hidden below the surface, and the staff of experts here is trying to devise various means of detecting it."

The U. S. Army wants flying in the air to be as safe as walking on the ground, and the personality of the pilot is as important as the motion of the motor, Major Poole says.

A machine now being built at Washington, D. C., at the U. S. Bureau of Standards under the direction of Dr. L. J. O'Rourke, psychologist, director of Federal Personnel Research, will mechanically probe the mental make-up of prospective fliers and aid in the elimination of those whose reactions make them unfit for the air.

Major Poole points out that Dr. O'Rourke, at the request of the Air Service, has undertaken the work as part of the extensive program of cooperation of the Personnel Research Division of the United States Civil Service Commission in industrial and personnel research problems involving selection and training.

The speed with which the man examined reacts to signals in color, light and sound, the rapidity with which he makes decisions of what to do in emergencies, the degree of coordination of his movements and other mental characteristics, will be determined by the machine.

The machine is expected to be put to work around March 1, and Capt. Neely C. Mashburn, chief psychologist of the school at Brooks Field, says that some such apparatus has been sought for because it is necessary that the verdict on the ability of the prospective flier be uninfluenced by the whims and peculiarities of the examining officer.

Emotional stability, in the opinion of Captain Mashburn, is the most important single characteristic of a good flier. Signs of nervous unbalance often do not show on the surface and no known measuring apparatus or mental test has been able to delve into a man's inner na-

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What we Know About Pneumonia

This is a summary of the present state of our medical knowledge about pneumonia.

When two out of five people die with lobar pneumonia in the sporadic outbreaks that occur every winter, the cry usually goes up that no progress is being made in the understanding or treatment of this highly fatal disease. In spite, however, of the very discomforting death rate that still prevails, there have been marked advances during the last fifteen years in all aspects of the pneumonia problem.

Types

In the first place it is no longer proper to speak of pneumonia in any but a very general sense. We should say instead, the pneumonias, for there are four distinct types. While the outer aspects of a case of any one variety compared to another would to the lay mind probably seem pretty much alike, to the modern physician the determination of the particular type in each case is nearly indispensable.

Types I and IV, for instance, are the milder types with death rates around 20 to 25 per cent. Types II and III are the severe types with death rates that range from 40 to 50 per cent. Happily, Types I and II constitute at least 70 per cent of all the pneumonia cases and the other two make up the remaining 30 per cent.

Mild Type I is the characteristic pneumonia of the young. It constitutes about half the lung pneumonias that attack young people up through the early years of adult life. Severe Type III usually attacks people past the prime of life, especially women. The high death rate of Type III is probably due to its prediliction for the old and its tendency to run a longer course than the others.

Serious complications from other infections occur more frequently with Type I than with the others, but Type II is the one pneumonia of septicemia, and when septicemia sets in the end is almost always fatal. Types I and II are pneumonias that can be picked up first hand, but III and IV usually appear after the patient has contracted some other respiratory infection.

Epidemiology

The Rockefeller Institute for Medical Research has found out much about how pneumonia spreads. The globular germs known as pneumococci that cause the first three types are rarely found in normal throats, by Type IV pneumococci occur in about half the throats of healthy individuals.

Nurses or anyone in close contact with a case of pneumonia are quite likely to pick up the germs and become carriers, and it is a fairly safe guess scientifically, that it is by such carriers that pneumonia spreads from person to person. Since Type IV is usually secondary and is so often on hand the chances are strong that with this variety the patient receives the infection from his own throat. In general it may be said that the pneumonias are acquired by contact just like a cold in the head.

To prevent the spread of pneumonia the patient should, of course, be isolated and everything about him scrupulously disinfected. It has been established that human carriers are an important factor in the spread of this disease, but at present there is no legal effort made to control them. Authorities say that such control may be a possible development of the future.

Oxygen Treatment

Oxygen plays an important role in modern treatment of pneumonia. The inflammation in the lungs interferes with the normal supply of oxygen to the blood and the symptoms of oxygen hunger ensue that occur in healthy people when they reach high altitudes in mountain climbing. In a patient struggling with pneumonia such a condition is an undesirable complication that oxygen administration is designed to counteract. Apparatus has been devised by which regulated amounts of the essential gas are released in the patient's pharynx through a rubber mouthpiece that brings the oxygen concentration of the blood up to

Cause of Death

A generation ago it was commonly thought that death in pneumonia was due to heart failure. While this may be true in a general sense, according to Dr. Russell L. Cecil, who has worked on pneumonia problems at the Bellevue Hospital for many years, it is little different from other infections which are subject to control as long as they are isolated, but become a serious menace when the bacteria break out into the general circulation. The virulent germs re-

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lease toxins that act on medullary centers and so cause a heart reaction. From studies made at the Bellevue approximately 90 per cent of the fatal cases of pneumonia showed large numbers of pneumococci in the blood during the last day or two of life.

Serums and Vaccines

Although pneumonia still takes an annual toll of human life almost as great as tuberculosis, so many advances have been made in the last few years in understanding how the human body actually stages its recovery from lobar pneumonia that medical authorities feel that the future outlook for the treatment of this disease is decidedly hopeful.

Medical experts now know that, at what is popularly known as the turning point in a case of pneumonia, a number of immune substances appear in the blood. It is equally well established that it is impossible for the toxin releasing pneumococci to stay in the blood after enough of immune bodies have made their appearance. It appears that they are able to do something to the pneumococci that makes them fall an easy prey to the white corpuscles of the blood. They are readily disposed of by these leucocytes of the blood stream, once there is enough of the immunizing substance present.

The natural thing to do when these facts were established was for experts to work out a way of preparing this immune substance in the laboratory so it could be administered to the patient to help along and speed up the business of destroying the pneumococci in the blood. The process has been complicated by the fact that each of the four types of pneumonia produces its own type of immune bodies. In order to treat a case successfully the prepared serum must contain the special immune substance for that particular kind of pneumonia from which the patient was suffering. To meet this condition various sera have been put into practical use for pneumococcus pneumonia that all contain specific immune bodies that work against more than one type of the disease.

The big problem at present in the specific therapy of pneumonia is to get in an adequate amount of the immune substance without shocking the patient. As soon as the chemist has purified anti-pneumococcus serum to such a point, the specific treatment of pneumonia will be just as efficient as that for diphtheria or scarlet fever, though here, as in other infections, early treatment is essential.

During the World War the value of preventive vaccination was amply demonstrated. Thousands of soldiers were vaccinated with a triple pneumococcus vaccine with very satisfactory results. Dr. Cecil, quoted above, says that it is a comparatively simple matter to vaccinate monkeys against the different pneumonias and have them remain immune from six to eight months. He recommends vaccination as a practical prophylactic measure for soldiers in armies and for individuals who have had several attacks of pneumonia and live in fear of others. The results, he says, from vaccinating several such persons in his experience, have been very good for in each case there have been no recurrences. With a concentrated and purified solution of pneumococcus immune bodies it should eventually be possible to maintain the sterility of the patient's blood in all types of pneumococcus pneumonia, and thereby cause a marked reduction in the death rate of this dreaded disease.

Why Flyers Fly

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ture and prove whether or not he could stand up under an extreme strain. Even the trick horrors of initiation stunts do not go deep enough.

For this reason, aside from machine-made tests and medical examinations flying students have to undergo, each applicant is now subjected to a searching personality study. The past life of the applicant is as carefully gone over as his eyesight, hearing or heart action. The way in which he is found to have faced emergencies in his past life indicates how he will probably behave in the air in the future, Captain Mashburn believes.

The United States is making rapid advances in the psychological study of its future fliers, Major Poole said, and the very low mortality in the American flying services is due to this.

In the United States only about a dozen lives were lost during 1926, while in England in only eleven months of that year there were 81 deaths and 51 accidents. There were 230 crashes in the British service where the machines were wrecked beyond repair.

"It is my opinion," Major Poole said, "that 90 per cent of all accidents are due to the pilots and not to the construction of the plane. Machines today are almost foolproof, and it is easier to get good mechanics than experts to pick out the men who will not kill themselves."

An apple tree should have at least 30 to 50 leaves to each apple.

Virginia ranks next to California in the amount of annual sunshine received.

The cat flea and dog flea are distinctly different, though both infest cats and dogs.

Farmers sometimes dust grains of corn with powdered talc before planting them, to make the corn unattractive to crows.

Honesty in children is greater in proportion to their intelligence, according to an investigation with New York school children.

Choctaw and Hopi Indians have the reputation of being particularly musical, according to Frances Densmore, student of Indian music.

BIOLOGY—PSYCHOLOGY

Mistakes of Animals Affect Evolution

By WILLIAM E. RITTER

Dr. Ritter, president of Science Service and professor emeritus of zoology of the University of California, has studied the behavior of animals as a key to understanding human activities. His book, THE NATURAL HISTORY OF OUR CONDUCT, has just been published.

Instinct in animals has been glorified by many naturalists. They talk of it in tones of hushed awe, as though all instinctive acts were divinely inspired and therefore could not possibly go wrong. As a matter of fact, however, many things done at the dictates of instinct are done at the wrong time, or in the wrong place, or are repeated to a senselessly unnecessary extent, so that they waste the energy of the animal; or they may even do the animal actual bodily harm. Such wasteful or harmful instinctive acts must obviously handicap the animal in its struggle for a living, and I have therefore called them "maladaptive" activities.

The woodpecker, equipped to store nuts in holes which he has pecked in trees, pecks far more holes than he ever fills, and fills far more than he or his fellows ever empty. If a woodpecker's time and his acorns are worth anything to him (and they certainly are if his life is worth anything to him) this excessiveness of activity is wasteful and may be positively harmful.

The organism tends not only to excessiveness but also to misdirection of otherwise advantageous activities. The woodpecker who stores pebbles instead of acorns has plainly chosen the wrong objects for his activity; judged as a food-storing enterprise this undertaking is a failure, however neatly the pebbles are fitted into the holes.

There are many activties which, though typically promotive of welfare, become positively subversive under some conditions, as when carried beyond a certain quantitative optimum. Eating, no matter how good the food or how much needed, may be carried to excess by any organism.

That the tendency to excessiveness of action is manifest in many kinds of monkeys and apes there appears no room for doubt. A little experimental observation of my own on a half-grown female mandrill is illustrative of one phase of excessive activity. By mid-afternoon on days when visitors were numerous the monkeys would be so "fed up" on peanuts and other things that their need for food would be wholly gone, and their desire for it and tendency to respond positively toward it almost gone. When a peanut was offered to the individual in question she would slowly and as it seemed absent-mindedly reach through the bars for it, take it in her hand and put it into her mouth, crack it and perhaps eat a portion of the meat, casting aside the rest, or perhaps not eat any of it.

Such was her procedure when no resistance whatever was put in the way of her taking the nut offered to her. But when I held the nut where she could not quite reach it or so tightly that considerable effort on her part was necessary to get it away from me, the whole proceeding took on quite a different character. Anger was manifest in all her mien and effort, eyes flashing, teeth showing, and all arm and body movements greatly quickened and intensified. The most significant thing done under the altered state was to the nut, once it was secured. With steel-trap-like speed it was carried to the mouth, with equal force and speed smashed to bits by a single snap of the jaws and teeth, and the whole mass of fragments, meat and shell commingled, thrown away with a speed and force in keeping with all the rest of the performance. Not the slightest move to eat the nut was made in any of the many instances in which I balked her taking it. Here was a series of acts unmistakably performed originally and basically in behalf of the creature's food necessities, but in a particular situation gone through repeatedly not only without answering in the least to the original purpose, but being actually contrary to that purpose.

Instances of birds becoming extinct "at the hand of man" are only too well known. A fact which has been largely neglected by writers is that the birds themselves have contributed to their own destruction.

Hawaiian natives, birds and men, furnish an illustration. The Hawaiian goose which has undergone the remarkable change of habit of becoming entirely a land goose has at the same time adopted certain habits which make it an easy prey to the native hunters. It attaches itself so rigidly to certain localities for breeding-places that it returns to

(Just turn the page)

MEDICINE

Washington's Death

The people who do not take care of colds have a "horrible example" confronting them in the death of the Father of his Country, according to Dr. Walter A. Wells, Washington, D. C., a specialist in disorders of the nose and throat.

Dr. Wells has just reported to the Medical Society of Virginia his findings from an analysis of the existing data on the death of Washington in the light of modern scientific knowledge. The great general undoubtedly hastened his end by not removing his wet clothes when he came home from riding over his estate in the rain at the beginning of his fatal illness. When the cold had settled in the throat, producing hoarseness, "he persisted in using his voice in reading aloud," said Dr. Wells, "thus doing the very thing that would tend to increase the congestion and intensify the inflammation of the parts particularly affected."

"All information available," continued Dr. Wells, "leads us to believe that the malady responsible for his death was an acute inflammatory edema of the larynx, an affliction which attacks the tissue lying beneath the mucous membrane." It is characterized by painful swelling of the larynx, causing great difficulty and pain in swallowing. Diphtheria, acute laryngitis and pneumonia have been reported as the cause of his death by various authorities.

At the present time with such a case, Dr. Wells explained, the operation of opening the trachea to allow the direct ingress of air to the lungs would be performed. There is a chance but not a certainty that it would save the patient's life.

Washington's physicians are not to be blamed, he said, for not performing this operation because its use in such cases did not have the indorsement of the medical authorities of the day.

Science News-Letter, February 19, 1927

PHYSICS

Jazz Of The Spheres

Quotation from STARS AND ATOMS—Arthur S. Eddington—Yale University Press.

I am afraid the knockabout comedy of modern atomic physics is not very tender towards our aesthetic ideals. The stately drama of stellar evolution turns out to be more like the hair-breadth escapades on the films. The music of the spheres has a painful suggestion of—jazz.

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Mistakes and Evolution

(*Continued from page* 117)

them year after year. This the hunters learn and take advantage of for making prey of the geese. The rigidity of habit is the more destructive to the birds in that when the young are being led around by the parents, neither old nor young being able to fly, the old because moulting and the young because not mature enough, the hunters are able to run the birds down and kill them.

Certain species of small Australian parrots (Lorikeets) have become nearly extinct. The musk lorikeets quickly betray their nest by harsh screeching, and only have to be watched for a few minutes in order to detect it.

Of another species, the purple-crowned Lorikeet, we have the following by E. B. Nicholls: "If you fire a gun or shout out loudly the whole flock dart toward the ground like a flash, and fly with amazing speed only a few feet above the grass. The aborigines, taking advantage of that peculiarity, used to build a sort of brush fence, whitewashing it with the pipeclay mixture they used in their corroborees. When the birds passed overhead, the blacks raised a great clamor, and the panic-stricken parrots, dropping to earth, flew into the brush and were caught in hundreds."

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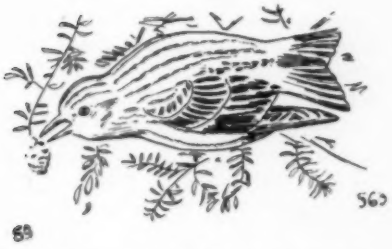
BIOLOGY

NATURE RAMBLINGS

By Frank Thone

Two Winter Neighbors



To see a pine siskin is a very good test of one's persistence as a bird lover and of one's ability as a bird observer. For the siskin is a most fickle fowl in the matter of its choice of a winter range, or even of a summer breeding ground, often deserting a region altogether for four or five years on end, and then suddenly reappearing in considerable numbers. And at best it is never so numerous that you can catch a half-dozen with a sweep of your hat. Siskins stick pretty faithfully to places where there are plenty of evergreen woods, and if you want to see them you will have to go into such places to find them.

They are very attractive little birds, marked over head and throat and back with close longitudinal stripes of light and dark brown, as shown in the illustration, with deep chocolate or black wing and tail feathers touched up at the bases with bits of canary yellow. That color bears the tale of their kinship, for they are closely allied to the finches, and like all of their tribe they are fond of indulging in two things; long stretches of trilling melodious song, even in winter, and a heavy diet of seeds. Their little beaks are sharp and strong, and are well adapted to digging and tearing into the tough cones of the evergreens to get at the meaty seeds among the scales.

"Bark-inspector-extraordinary-with-powers-of-extradition." That is the nuthatch. He is one of the cheerfulest, sauciest, topsy-turviest of our winter birds, and withal one of the most useful. "Frllip!" he alights against the side of a tree trunk, and he sticks in whatever posture he alights, whether rightside up or upside down or sideways. Immediately he begins inspecting for hidden cocoons or hibernating insects or their eggs, and what he finds he pulls out and devours. His strong little toes are fitted for the wide variety of grips they must take, better than those of the

(*Just turn the page*)

HYGIENE

Parents Lend Immunity

Will the solution of the measles and whooping cough problems be found right in the home?

When either of these diseases make their appearance in a German family it is the current practice to prevent those diseases or to forestall serious complications by inoculating the exposed children with blood from their parents, according to Prof. Rudolf Degkwitz, European authority on measles. Prof. Degkwitz is director of the children's clinic at the University of Greifswald in Germany and is engaged at present in measles research at the U. S. Public Health Service.

In the densely populated countries of Europe, he explained, the chances of reaching full-grown manhood or womanhood without contracting measles or whooping cough are very small. It has been established, he said, that the periodic subsequent exposures to both diseases resulting from the contacts of every day life stimulates during the whole life production of antibodies in the blood. Consequently the blood of most of the adult population of Europe or of any big city in any country is a convenient immunizing agent that can be used to prevent those diseases or to mitigate their severity in children.

"When a German child 'comes down' with either whooping cough or measles," said Prof. Degkwitz, "the physician uses the blood of the father or mother to inoculate the other children in the family. When this is done early enough in 50 per cent of the cases treated the diseases are prevented and an immunity for several months is established. In the other 50 per cent very mild forms of the diease ensue that confer as lasting an immunity on the young patient as a severe case. Measles and whooping cough in such cases are so mild, that as a rule the children do not feel ill at all and cannot be kept in bed. Since the efficacy of this method depends on its early use, German health authorities are endeavoring to teach this vital point to parents through propaganda distributed to school children." The health section of the League of Nations likewise advocates this mode of treatment, he added.

Prof. Degkwitz has been working with an animal serum to be used as a measles preventive and curative which is made from the blood of

(*Just turn the page*)

AERONAUTICS

Helium Shortage Exists

America faces a helium shortage. And helium is the unburnable gas that, although undiscovered on earth before 1895, is used to inflate dirigibles and thus keep them from exploding as those filled with hydrogen are likely to do.

The natural gas from the Petrolia, Tex., field which has provided helium up until now is playing out. Since Congress has authorized the construction of two giant dirigibles, each 6,000,000 cubic feet capacity, to cost $8,000,000, lack of helium is worrying government officials. The Navy and the U. S. Bureau of Mines are asking Congress to appropriate money to pipe to the Fort Worth, Tex., helium extraction plant, built during the war, the helium-bearing natural gas of Nocona, only 25 miles from Petrolia.

The appropriation desired is $500,000 which is needed to construct the necessary pipeline and pressure plant. The bill is now awaiting action by the Senate. Once the money is appropriated it will be a matter of only six or seven months before the helium supply can be increased.

The Nocona field was discovered in 1922 but natural gas, although burned in the field, has never been drawn away. The life of the Nocona supply is about 15 years and it will probably produce from 10 to 12 million cubic feet of helium a year during that time.

More helium is essential with the construction of two giant dirigibles in view. There was never enough helium to float the Los Angeles and the Shenandoah simultaneously. With the destruction of the Shenandoah the world's largest single store of pure helium was lost. Each of the projected giant dirigibles will need three times the helium now being used by the dirigible Los Angeles.

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GEOLOGY

Kilauea Growing Uneasy

Kilauea volcano, the largest of known active peaks, is showing signs of uneasiness, according to Director T. A. Jaggar of the Hawaiian Volcano Observatory. The seismographs at Volcano House are recording frequent earthquakes, there has been a marked increase of avalanches into Halemaumau Pit, and there are yellow sulphurous patches on the slopes which are increasing in area.

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THEY SAY—

Letters must be short, interesting and signed.

Straight Science, Uncolored

J. J. Arnaud, patent attorney, South Milwaukee, Wis., writes:

As soon as Science News-Letter was brought to my attention I subscribed immediately; and am extremely pleased with the excellent quality of your weekly.

I have for some time been turning over my copies, as I finish them, to the instructor in physics and chemistry in the high school of this town, a most estimable gentleman of culture and refinement.

Very recently he told me that he has been reading to his classes such parts as they can understand, and finds that, with your very simple presentations of scientific progress, he succeeds in holding their attention and stimulating their interest. "You know," he added, "most of the so-called 'Popular Science' is a sad mixture of a modicum of truth with a lot of nonsense, all presented in the most sensational way. I find the students very soon tire of such magazines; especially as, to be strictly correct, I have to modify or negative many of their statements. It does not do to read them something, and then discount half of it. They lose faith in all the rest. But I find they look forward to Science News-Letter with eager interest. They like it because it's straight science, uncolored, and told in way they can readily grasp. It flatters them that they can understand science that is not 'written down' to the general public."

A shrewd remark, that last!

Developed

L. L. Dickerson of the American Library Association:

This News-Letter has developed into one of the most interesting little magazines I have ever run across.

Enormous Value

W. L. Spencer, director of secondary education, Alabama Department of Education, in a letter to his principals:

The Science News-Letter will be of enormous value to science classes and teachers. I recommend it most highly.

Science News-Letter, February 19, 1927

Health measures are held mainly responsible for the decline in diphtheria deaths in New York State, from 6,500 in 1888 to 700 in 1926.

Pieces of suet tied to trees in cold weather are appreciated as heat producing food by woodpeckers, chickadees, brown creepers, and other birds.

Parents Land Immunity

(*Continued from page* 119)

immunized sheep. To obtain the best results it should be administered the first day of the disease, when the temperature begins to rise. He claims that the serum administered at this time prevents measles and finishes the fever after 24 to 36 hours or else modifies the disease to a very mild form. In both cases a lasting immunity follows. The serum is on the market in Germany and is being tried out experimentally in England and other countries.

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Water lilies are favorite food of wild ducks.

An automobile that can be run sideways has been invented to make parking easier.

During a recent storm in France the rain contained sand that had blown from Africa.

Doctors of the late Stone Age practised surgery with considerable skill and success.

A new steel which is hard on the surface and soft inside is said to be cheaper than alloys in use.

It is estimated that 500 million tons of helium are going to waste in this country every year.

A case of eruption strikingly like smallpox was discovered in an Egyptian mummy of about 1200 B. C.

Explorers from the British Museum found two bronze water pumps buried on the site of an ancient Etruscan city.

White ants of the tropics work in such armies that they sometimes destroy an entire building in a day.

A Nuremberg man who invented a ticking clock, in 1840, was accused of witchcraft by his wife and his neighbors.

One of New York's newest skyscrapers burns enough coal in a day to heat four averege sized homes all winter.

The oriental peach moth, which probably came to this country from Japan about 1913, is becoming a serious fruit tree pest.

The U. S. Department of Agriculture is studying the cost of snow removal in different states, to find the best and cheapest methods.

Nature Ramblings

(*Continued from page* 119)

woodpecker, which are one-purpose toes; and his stiff little beak, though no chisel like that of his bigger neighbor, is plenty good enough to act as a pair of tweezers for dragging his prey out to where he can devour it in comfort.

The nuthatch is a pretty little fellow, too: black on head and shoulders, blue on back and wings, white underneath except well aft, where he is ruddy-tinged. He's not a singer, though; his conversation is confined to a nasal "h'rank-h'rank!" and even his spring song sounds, as one observer has said, "strangely like mirthless laughter." But though his voice is not musical, his flights from trunk to trunk are short lyrics for those who can appreciate poetry in motion. They are a series of swift, dipping little rushes, staves of staccato wingbeats, a winter scherzo of the woods.

Science News-Letter, February 19, 1927

Fishes sometimes get sea-sick from train travel.

The population of the United States will be 118,628,000 by July 1, 1927, according to census estimates.

Men immigrants outnumbered women coming to this country in every year from 1820 to 1923, except in 1922.

New train equipment to make fish comfortable when traveling is expected to reduce mortality among adult fishes on long distance journeys.

Scientific Poetry Contest

Dust off your riming dictionaries, rumple up the pages of your favorite physics, chemistry or biology, set your poetry mill to working. For the Science News-Letter invites you to feed its omnivorous appetite with tidbits in which poetry and science are pleasingly combined. The scientific poetry contest is on!

Conditions: Poems, verses, rimes, jingles or what-have-you must be original and unpublished. They must express accurately some scientific fact or situation. Address: Poetry Editor, Science Service, 21st and B Sts., Washington, D. C. Keep a copy, as unavailable contributions can not be returned.

Prizes: One poem will be published each week beginning with the issue of March 5. A prize of $5.00 will be paid for each poem published.

First Glances at New Books

INTEGRITY IN EDUCATION AND OTHER PAPERS—George Norlin—*Macmillan* ($2). Twelve thoughtful essays, ranging in subject from Greek philosophers and poets to the modern educational—and philosophical—problem, to specialize or not to specialize.

Science News-Letter, February 19, 1927

HOW TO WRITE A THESIS—Ward G. Reeder—*Public School Publishing Co.* ($.90). The prospective Ph.D. who feels like a pioneer in a strange country when he plans and writes and publishes his thesis will find this little book a practical guide at every step. For more experienced scientists and educators who are beginning to contract the habit of writing theses, the book still contains much useful material, such as specimen pages showing arrangement of charts and statistics and suggestions regarding publication.

Science News-Letter, February 19, 1927

THE PLATOON SCHOOL—Edited by Alice Barrows—*The National Association for the Study of the Platoon or Work-Study-Play School Organization.* A new quarterly magazine designed as a forum for discussion and exchange of ideas for the workers with this new type of school organization.

Science News-Letter, February 19, 1927

THE RELATION OF BIRDS TO WOODLOTS IN NEW YORK STATE—W. L. McAtee—*New York State College of Forestry.* This publication, which appears as Vol. 4, No. 1, of the Roosevelt Wild Life Bulletin series, is much more than a mere series of economic notes on the importance of birds to domestic forestry. It gives concise and interesting summaries of habits and is illustrated with many halftones and four colored plates.

Science News-Letter, February 19, 1927

BIRDS OF CENTRAL NEW YORK MARSHES—Aretas A. Saunders—*New York College of Forestry, Syracuse.* A thorough-going piece of natural history work. An especially interesting feature is the appended series of rapid little outline sketches showing birds in characteristic acts or attitudes. There are two fine color plates by E. J. Sawyer.

Science News-Letter, February 19, 1927

The distant planet Neptune is so surrounded by dense clouds that its surface appearance is a mystery.

PSYCHOLOGY

Young Geniuses

Quotation from THE EARLY MENTAL TRAITS OF THREE HUNDRED GENIUSES. Catharine Morris Cox. Stanford University Press.

That all equally intelligent children do not as adults achieve equal eminence is in part accounted for by our last conclusion: youths who achieve eminence are characterized not only by high intellectual traits, but also by persistence of motive and effort, confidence in their abilities, and great strength or force of character . . . The superior youths considered in the present study pursued high ideals, developed significant interests, and created new expressions of scientific and philosophical thought before they had reached the age of manhood. Schelling had outlined his philosophy at 20, Hume had defined his views before he was 25, Milton at 21 wrote an ode pronounced by an eminent critic to be perhaps the most beautiful in the English language. Peel at 24 was Chief Secretary for Ireland, Raphael at 21 painted the *Granduca Madonna,* Beethoven at 18 was appointed Chamber Musician to his princely ruler, Newton had unfolded his doctrine of light and colors before he was 20, Bacon wrote his *Temporis Partus Maximus* before the age of 20. Montesquieu had sketched his *Spirit of Laws* at an equally early age, and Jenner, when he was still younger, contemplated the possibility of removing from among the list of human diseases one of the most deadly scourges of the race. Achievements like these are not the accidents of a day. They are the natural outgrowth in individuals of superior general powers of persistent interest and great zeal combined with rare special talents.

Science News-Letter, February 19, 1927

ZOOLOGY

Four-legged Chickens Studied

Chickens with two wings and four legs and even with four wings and four legs, and a duckling equally strangely constituted have been the subjects of studies by Dr. F. E. Chidester, of West Virginia University. He found freakish external features of the birds to be coupled with odd internal structures. Four kidneys were found in some of the birds, double cloacæ in all of them, and frequent variations in some of the digestive tubes. The gizzard, however remained single, nor was there any evidence of duplicity in the heart or respiratory apparatus.

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BIOLOGY

Sad Fate of Youthful Sponge

(Tune: John Brown's Body)

There was a little blastula no bigger than a germ,
Who performed invagination in his mother's mesoderm,
And soon his nascent cilia with joy began to squirm
In ecstacy supreme.

CHORUS
Oh, the joys of locomotion
Down within the depths of ocean,
Oh to feel the deep commotion
Within each blastomere!

No protozoan can ever guess the pleasure he did feel,
As he felt within his ectoderm a growing gastrocele,
With joy and pride his polar cells began at length to reel
In foolish self-content.

His gastrocele was filled with pride that comes before a fall,
And he felt his mother's ectoderm to be extremely small,
So he freed himself from all restraint by rupturing the wall
And floated out to sea.

But oh, alas for youthful pride as upward he did soar,
He caught a tuft of spiculae upon his blastopore,
And trying hard to get it off, his ectoderm he tore—
A great—big—ugly—rent.

"Oh mother dear," he cried in grief, "come quickly now and try
To heal my little ectoderm, or else I'll have to die!"
But his mother dear was sessile and could only sit and cry
From her excurrent pore.

Now every night his little ghost within the deep is found,
Lamenting to the annelids that burrow in the ground;
The hydroids wave their tentacles and shudder at the sound
Of this familiar strain—

—From Songs of the M. B. L., Woods Hole.

Science News-Letter, February 19, 1927

AGRICULTURE

Grains Increase Yield

Well bred wheat as well as pedigreed stock is making its value apparent to the farmers of North America. Eighty million more bushels a year come from the great wheat belt of Canada alone since farmers have taken to planting an improved variety of essential grain, Dr. R. J. Garber of West Virginia University declares. More than ten million acres of spring wheat in the United States are likewise planted with this variety. A considerable increase in the yield of oats per acre has been brought about as well by developing new varieties, particularly in Iowa.

Science News-Letter, February 19, 1927

PHOTOGRAPHS OF SCIENTISTS

Science Service has a collection of nearly 2,000 photographs of scientists throughout the world. The third installment of this list is published below. Although this list has been checked with care, corrections are requested, since a complete catalog will be issued later. Photographs of scientists not listed are desired.

For the convenience of teachers and scientific enthusiasts, these photographs are offered for sale. Any ten photographs (each postcard size 3⅛ x5⅜ inches) will be sent postpaid for only $2.00. Enlargements, 8 x 10 inches, are $1.00 each postpaid. Postcard pictures are finished only in black and white, but enlargements are offered either in black and white or sepia on buff stock. Please specify which.

Starred (*) photographs can be furnished as $1.00 enlargements only. Photographs at these prices are sold with the understanding that they are not to be used for publication.

C (Continued)

843 Cleland, Ralph E., Botany, Goucher College
649 Clemens, W. A. Biology, Univ. of Toronto
6060 Cleveland, L. R., Physiology, Harvard Med. School
5012 Clewell, C. E., Elec. Eng., Univ. of Penna.
1471 Clinton, Guy, Chemistry, Central H. School, Washington, D. C.
1047 Clowes, G. H., Chemistry, Eli Lilly & Co.
1395 Coates, Charles E., Chemistry, La. State Univ.
474 Cobb, N. A., Zoology, U. S. Dept. of Agr.
1151 Coblenz, William W., Physics, U. S. Bureau of Standards.
1187 Coe, W. R., Paleontology, Yale University
1408 Cofman, V., Chemistry, Armour & Co. Chicago.
1451 Cohen, Barnett, Chemistry, Hygienic Laboratory, Washington, D. C.
1468 Cohen, Lillian, Chemistry, Univ. of Minn.
128 Cohn, Edwin J., Chemistry, Harvard Univ.
112 Coker, R. E., Zoology, Univ. of North Carolina
401 Cole, Arch E., Zoology, Northwestern University
424 Cole, Elbert C., Zoology, Harvard Univ.
2047 Cole, Fay-Cooper, Anthropology, Univ. of Chicago
99 Cole, Leon J., Genetics, University of Wisconsin
465 Cole, Wm. H., Zoology, Lake Forest College
556 Coleman, A. P., Geology, University of Toronto
493 Coleman, Lawrence V., Amer. Asso. of Mus., N. Y.
98 Collet, Mary E., Physiology, University of Buffalo
368 Comstock, John A., Entomology, Los Angeles Acad. of Science
245 Collins, Juluis Lloyd, Genetics, Univ. of Calif.
6061 Compton, A. H., Physics, Univ. of Chicago
1428 Conn, H. J., Bacteriology, Agric. Exper. Station
1500 Conti, Prince P. Ginori, Chemistry, Italy
6020 Courie, Leslie J., Astronomy, Nautical Almanac, London
181 Conat, Dr. & Mrs. I. H., Psychiatry, Boston, Mass.
141 Conklin, E. G., Zoology, Princeton University
1007 Cook, Daniel, Zoology, Univ. of Cincinnati
852 Cook, R. S., Botany, Tulane University
1220 Cooke, Jean V., Pediatrics, St. Louis Childrens Hosp.
6063 Coolidge, W. D., Physics, G. E. Research Lab.
640 Coony, John P., Chemistry, St. Louis University
324 Coover, John E., Psychology, Stanford University
46 Copeland, Manton, Zoology, Bowdoin College
546 Cornell, B. S., Research Dept., Univ. of Toronto
973 Cottrell, F. G., Chem., Fixed Nitrogen Lab., Washington, D. C.
1373 Coulter, John M., Botany, Boyce-Thompson Inst.
711 Cowan, John F., Medicine, Stanford Univ.
42 Cowdry, E. V., Anatomy, Union Med. College, Peking, China
405 Cowdry, N. H., Botany, New York City
589 Cowles, H. C., Botany, University of Chicago
1113 Coy, George J., John Hopkins University
1397 Coyle, George L., S. J., Chemistry, Georgetown University
797 Craighead, F. C., Entomology, U. S. Dept. Agr.
1477 Crane, E. J., Chemistry, Ohio State Univ.
531 Crane, G. W., Psychology, Northwestern Univ.
567 Crane, Jasper A., Pharmacology, Univ. of Toronto
1353 Crane, V. B., Toben Innes Hort. Inst., London.
579 Crawford, F. H., Physics, Northwestern Univ.
918 Crew, F. A. E., Genetics, University of Edinburgh
575 Crew, Henry, Physics, Northwestern University
1376 Crocker, Wm., Botany, Boyce-Thompson Inst.
1051 Crossley, Miss K. M., Physics, Univ. of Toronto
930 Crowther, J. G., Mathematics, Oxford Univ. Press
854 Cummins, Harold, Anatomy, Tulane University
1099 Cunningham, G. Watts, Philosophy, Univ. of Texas
993 Currelly, A. T., Ontario Museum
5011 Curie, Irene, Chemistry, Paris, France
6064 Curtis, H. D., Astronomy, Allegheny Obs., Pittsburg
423 Curtis, W. C., Zoology, University of Missouri
800 Cushman, R. A., Entomology, U. S. National Mus.

D

1138 Dahlgren, Ulric, Zoology, Princeton Univ.
10027* Dalton John, Chemistry
65 Danforth, C. H., Anatomy, Wash. Univ. Sch. Med.
1002 Danner, Phillip S., Chemistry, Calif. Inst. of Tech.
189 Daniel, J. Frank, Zoology, Univ. of Calif.
1483 Darbaker, L. K., Bacteriology, Univ. of Pittsburgh
91 Dart, R. A., Anatomy, Witwatersrand Univ., Johannesburg, S. Africa
345 Darwin, C. G., Physics, Calif. Inst. of Tech.
896 Davenport, C. B., Zool., Cold Spring Harbor, N. Y.
386 Davies, I. J., Zoology, Rice Institution
196 Davis, Alva R., Plant Physiol., Univ. of Calif.
1378 Davis, J. J., Botany, Madison, Wis.
2008 Davis, Watson, Engineering, Science Service, Washington, D. C.
40 Dawson, J. A., Protozoology, Harvard Univ.
695 Dawson, Percy M., Physiology, Univ. of Wisconsin
984 Dawson, W. Bell., Survey of Tides & Cur., Ottawa
289 Dawson, William L., Ornithology, Santa Barbara, Calif.
243 Day, A. L., Zoology, Univ. of the Philippines
790 Dean, George A. Entomology, U. S. Bur. of Ent.
6065 Debye, Physics, Zurich, Switzerland
1280 deCampos, F. A., Physiology, Harvard Med. School
10017* Dedrick, B. W., Milling Engi. Penna. State College
1153 DeForest, David M., Zoology, Union College, N. Y.
360 Dellinger, S. C., Zoology, Univ. of Arkansas
1121 Dembowski, Jan, Biology, M. Nencki Inst., Warsaw, Poland
1122 Dembowski, Wiktorja S., Biology, M. Nencki Inst., Warsaw, Poland
764 Deming, Miss J. M., Anatomy, Univ. of Calif.
1180 deMol, W. E., Botany, Amsterdam, Holland
10018* Democritus, Philosophy, Greece.
159 Dennis, Miss W., Biology, Tulane University
903 deRenyi, G. L., Histology, Univ. of Penn.
990 Derick, Carrie M., Botany, McGill Univ.
269 Dershem, E., Physics, Univ. of Calif.
10019* Descartes, Rene, Philosophy, France
461 Detlefsen, J. A., Genetics, Univ. of Penna.
449 Detwiler, S. R., Anatomy, Peking Union Med. College, China
938 DeVillamil, R., Royal Engineers, West Hampstead, England
242 Dickey, Donald R., Naturalist, Pasadena, Calif.
10027* Dickson, Leonard E., Mathematics, Univ. of Chicago
1173 d'Irsay, Stephen, Physiology & Hist. of Med., Yale Univ.
915 Dixon, Henry H., Botany, Trinity College, Ireland
223 Dixon, J., Mammalogist, Univ. of California
296 Doane, Rennie W., Entomologist, Stanford Univ.
825 Dodd, L. E., Physics, University of California
6050 Dodge, Raymond, Psychology, Yale University
642 Dolley, David Hough, Pathology, Wash. Univ. Med. School
1284 Domin, Karel, Botany, Charles Univ., Prague
1319 Demmeter, Karl Y., Bacteriology, Veihenstephan College, Germany
7 Donaldson, H. H., Anatomy, Wistar Inst. of Anatomy
885 Donaldson, John Calvert, Endocrinology, Univ. of Pittsburgh
742 Dore, W. H., Plant Nutrition, Univ. of Calif.
10021* Dorsey, George A., Psychology, New York
787 Dorsey, Ernest N., Physics, Intl. Critical Tables, Wash.
1110 Drane. Joseph, Anatomy, John Hopkins Med. School
689 Dresbach, Melvin, Physiology, Albany Med. Sch.
297 Drew, E. R., Physics, Stanford University
2 Drew, Gilman A., Zoology, Woods Hole, Mass.
951 Duane, William, Biophysics, Harvard University
1171 Duggar, B. M., Botany, Missouri Botanical Garden
820 Duggar, J. F., Agronomy, Univ. of Calif.
1188 Dunbar, Carl O., Geology, Yale University

(To be continued)

SCIENCE SERVICE

Photographic Department

21st and B Streets **Washington, D. C.**

Anniversaries of Science

February 23, 1843.—Congress passed a bill appropriating $30,000 for the Morse telegraph.

Let me not be misunderstood as appropriating to myself the credit of the many modifications of the telegraph that have since been made in every part of the world, because I claim the invention of the generic telegraph. I do not pretend that the mechanism of the first forms of the telegraph was not rude, and even uncouth when compared with the beautiful workmanship of the European ateliers, of the hundreds of accomplished mechanicians who have brought to the work their incomparable ingenuity and skill. And yet I may appeal to the fact, generally acknowledged, that the essential features of the original invention have not been obliterated; they can be easily and distinctly traced through all the improvements made in the various parts by which the different processes of the art have been more easily performed, —S. F. B. Morse: from a paper given at the International Exposition, Paris, 1868.

February 24, 1468.—Johann Gutenberg died. He invented printing with movable type.

The development of free discussion in Europe during this age of fermentation was enormously stimulated by the appearance of printed books. It was the introduction of paper from the East that made practicable the long latent method of printing. It is still difficult to assign the honour of priority in the use of the simple expedient of printing for multiplying books. It is a trivial question that has been preposterously debated.

—H. G. Wells: *The Outline of History.*

March 1, 1813.—Michael Faraday was appointed assistant in the laboratory of the Royal Society, under Sir Humphrey Davy.

Great as is the debt which electrical science owes to Ampère, it is exceeded by its obligation to Faraday whose marvelous experimental skill and instinctive perception of the inner nature of phenomena are still the wonder and admiration of all men of science. At twenty-one years of age he was a journeyman bookbinder, who had educated himself in some degree by reading the books which he was given to bind. The Encyclopedia Britannica aroused his interest in science and he applied to Davy for employment in the Royal Institution. For a number of years, as Davy's assistant, his chief work was in chemistry; but Oersted's discovery turned his thoughts toward electricity and thereafter it was his principal field of work. In 1831 he made the capital discovery of the introduction of currents, which is not only of the most fundamental consequence to the theory of electromagnetism but is the foundation of the innumerable practical applications of electricity to the uses of man.

—H. A. Bumstead: in the *Development of the Sciences.*

Science News-Letter, February 19, 1927

Tungsten weighs about as much as lead.

EVOLUTION

Anti-Evolution Fights Fail

The anti-evolution forces in the Arkansas Legislature, after getting their bill through the House of Representatives by the close vote of 50 to 47, encountered unlooked-for difficulty in the Senate, where the measure was tabled by an overwhelming aye-and-nay vote. There were two anti-evolution bills introduced in the House early in its session, but in view of the decisive action of the Senate against the first it is regarded as unlikely that any serious effort will be made to push the second. Arkansas is the fourth state to go on record this year as unwilling to interfere with the teaching of science, West Virginia, Missouri and New Hampshire having already disposed of bills introduced into their legislatures.

The idea of combating the teaching of evolution by repressive legislation seems to be losing popularity among the evangelical clergy of the South, until now considered its chief supporters. The Educational Association of the Methodist Episcopal Church, South, has gone on record during the past few days as opposing such legislation, and individual ministers and laymen of other sects have expressed themselves as in sympathy with this attitude.

Science News-Letter, February 19, 1927

PHYSICS

Music from Radio Squeals

The squeals of a regenerative receiving radio set, so annoying to neighboring listeners, may be turned into music, for Dr. Raymond Morgan, of the University of Pennsylvania, has devised the oscillophone, a device which tames and tunes the radio squeals.

The source of the squeals in Dr. Morgan's apparatus was a five watt power radio tube, such as many modern radio sets use in the last stage of amplification. This tube was made to oscillate, or squeal, which was evident through the loud speaker connected to it. Then by operating keys, various "capacities" were placed in the tube circuit, changing the pitch from middle C of the piano to several higher notes. A tune can be played, the notes being peculiarly clear, because, unlike ordinary musical instruments, the sound waves vibrate in one way only. With a vibrating string, as in a piano, the note is not pure, because besides the principal note, it also emits vibrations which are multiples of the rate of vibration of the fundamental note.

The application of the device to radio was shown when the oscillating tube was connected to an aerial, without the loud speaker, and without any sounds from the transmitter, a nearby receiving set reproduced the music.

Science News-Letter, February 19, 1927

ZOOLOGY

Singing Earthworms

If you ever hear earthworms singing, you need not conclude at once that you need either to be psychoanalyzed or to take the pledge. Earthworms do sing, according to a critical scientific witness, Dr. Rudolph Ruedemann, of the New York State Museum, who confirms by observations on the vocalizations of American earthworms the report of a saengerfest of German worms sent in by a Freiburg scientist, Prof. Mangold.

"It was first pointed out to me by Mrs. Ruedemann, on a sultry May evening, that the earthworms in our garden back of the house could be distinctly heard," says Dr. Ruedemann. "Being incredulous at first, I sat quietly on a chair until I also heard an exceedingly fine rasping noise all around me. It was a chorus of almost unbelievably small voices in the dark. To find out whether the little musicians were really earthworms, I got a flashlight and when the voices, after the quiet resulting from the disturbance of walking over the ground, were again in full chorus, turned the light upon a point close to me, from which I was sure a rasping sound arose. The light revealed a large earthworm, partly stretched out of its burrow. I spotted several more afterwards. We two have since heard the singing every year, always on warm spring evenings about and after dusk. Mrs. Ruedemann also heard it last spring about four o'clok in the afternoon on a warm May day after a rain, and then she could see the 'singing' worms all partly stretched out of their burrows."

Dr. Ruedemann is of the opinion that the worms produce the sound by dragging the exceedingly fine bristles under their bodies over some hard object at the edge of their burrows, fiddle-bow fashion. The German scientist disagrees with him, and thinks that the worms do their singing with their mouths, clicking them open and shut so rapidly as to produce a fine buzzing noise. An associate of Dr. Ruedemann's, S. C. Bishop, of the State Museum, intends to make a study of the matter this spring and if possible settle the question.

Science News-Letter, February 19, 1927